RESEARCH ARTICLE

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Lichenized fungi (*Ascomycota*) from Dupkata Reserve (Rhodopi Mts, Bulgaria)

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ABSTRACT
Results from the study on lichens in the Dupkata protected area, Rhodopi Mts are presented. Fifty-one species of lichen-forming fungi were reported for the first time from the Reserve. Among them, *Arthopyrenia analepta* s.l. and *Lecanora argentata* were new records from the Rhodopi Mts. Data on some rarely recorded and less common species in Bulgaria were briefly discussed.

Key words: Lecanoromycetes, lichen diversity, Pazardzhik, protected area

Introduction

Dupkata Reserve was declared as a strict reserve in 1951 with an area of 65.2 ha. It is situated in Western Rhodopi Mts, mainly occupying the southern slopes of Batashka Mt and part of the Valley of Devinska River, generally between 600 and 1600 m altitude (Fig. 1). To the present days the area of this managed reserve is extended to 1210.8 ha. Its territoty belongs to Pazardzhik region, Batak municipality and Fotinovo village. The reserve was proclaimed for protection of wild flora and fauna, mainly century-old Scots pine forests and the Red deer. It is listed in the UNESCO's Man and the Biosphere Programme by the Executive Environment Agency (Register of protected territories and protected areas in Bulgaria, 2025).

Velev et al. (2015) published data on the vascular flora, mycota and the vegetation from Dupkata Reserve. In their work, the fungi are presented with 42 species (ascomycetes, basidiomycetes, and 3 of them of conservation concern). The vegetation cover is composed mainly by spruce forests and mixed spruce and *Pinus sylvestris* communities, and five habitat types of Council Directive 92/43 EEC are found in the area of Dupkata Reserve (Velev et al., 2015).

Prior to the present work the diversity of lichenized fungi from Dupkata Reserve was completely unexplored. General information about the lichens recorded from Rhodopi Mts is available in some works (e.g. Popnikolov & Zhelezova, 1964; Mayrhofer et al., 2005; Denchev et al., 2006; Vondrák, 2006; Vondrák & Slavíková-Bayerová, 2006). Some recently published data, resulted from regional studies on lichens and lichenicolous fungi in the country and in this mountain, is presented in Atanassova and Mayrhofer (2012), Stoykov (2015, 2018a), Guttová et al. (2020), Mayrhofer et al. (2020), Shivarov et al. (2021), and Stoykov (2023).

The following work aims to contribute to the lichenized fungi on the territory of the Dupkata Reserve.

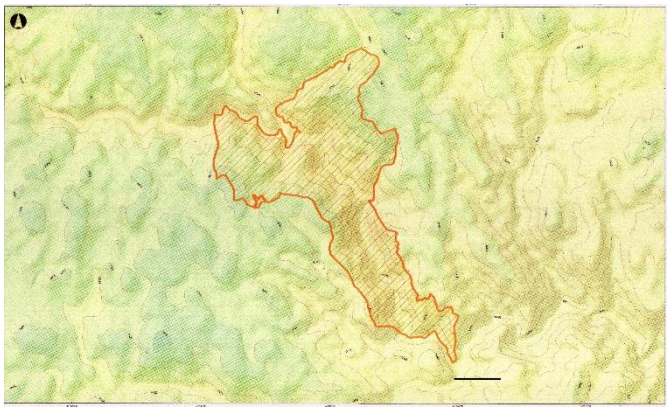

Figure 1. *Map of Dupkata Reserve. Size 1: 25000. Scale bar = 1 km. (MOEW & Nishava Consortium. Management Plan of Dupkata Reserve, 2015).*

Materials and Methods

Method of linear transect for collecting of lichen thalli was used. The determination of the collected materials was made generally following Dobson (2000, 2011, 2013), Smith et al. (2009) and Nimis (2025). Colour macro- and microphotographs were made with the help of Canon PS

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A460, Canon Ixus and Agfa Photo DC8200 digital cameras. Specimens were found in localities with geographic coordinates, marked with the help of GPS receiver model Garmin Etrex10, all along the track in direction between N 41°46′28″, E 24°14′45″ and N 41°46′03.5″, E 24°15′55.2″. The nomenclature of the species follows Denchev et al. (2022). Classification system of the ascomycetous fungi was accepted in accordance with '*Outline of Ascomycota*' (Wijayawardene et al., 2018). The specimens were deposited at the Mycological Collection of the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Sofia (SOMF).

Results and Discussion

As a result of the short field trip, held during the summer of 2014, fifty-one species of lichenized fungi were reported in the territory of Dupkata Reserve. They belong to phylum *Ascomycota*, subphylum *Pezizomycotina*, and are united in 3 classes (*Arthoniomycetes*, *Dothideomycetes* and *Lecanoromycetes*), 6 sublclasses, 13 orders, 18 families, and 34 genera.

List of the lichenized fungi from Dupkata Reserve

Phylum *Ascomycota*
Subphylum *Pezizomycotina*
Class Arthoniomycetes
Subclass Arthoniomycetidae
Order Arthoniales
Family *Chrysotrichaceae*
1. *Chrysothrix candelaris* (L.) J.R. Laudon, tree bark
Class Dothideomycetes
Sublass Pleosporomycetidae
Order Pleosporales
Family *Arthopyreniaceae*
2. *Arthopyrenia analepta* (Ach.) A. Massal. s.l., bark of beech
Клас Lecanoromycetes
Subclass Candelariomycetidae
Order Candelariales
Family *Candelariaceae*
3. *Candelariella vitellina* (Hoffm.) Müll.-Arg., tree bark, rock
Subclass Lecanoromycetidae
Order Caliciales
Family *Physciaceae*
4. *Amandinea punctata* (Hoffm.) Coppins & Scheid., bark of twig (Fig. 6)
5. *Rinodina sophodes* (Ach.) A. Massal., bark of twig (Fig. 7)
Order Lecanorales
Family *Cladoniaceae*
6. *Cladonia fimbriata* (L.) Fr., soil, old trunk
7. *Cladonia furcata* (Huds.) Schrad., mossy soil
8. *Cladonia pyxidata* (L.) Hoffm., mossy trunk
Family *Lecanoraceae*
9. *Lecanora albella* (Pers.) Ach., bark of *Sorbus*
10. *Lecanora argentata* (Ach.) Röhl., bark of beech
11. *Lecanora pulicaris* (Pers.) Ach., coniferous twig
12. *Lecanora varia* (Hoffm.) Ach., tree bark
13. *Lecanora rupicola* (L.) Zahlbr., rock
14. *Protoparmeliopsis muralis* (Schreb.) M. Choisy, rock (Fig. 10)
Family *Parmeliaceae*
15. *Bryoria fuscescens* (Gyeln.) Brodo & D. Hawksw., coniferous twig
16. *Bryoria implexa* (Hoffm.) Brodo & D. Hawksw., coniferous twig
17. *Bryoria subcana* (Nyl. ex Stizenb.) Brodo & D. Hawksw., coniferous twig
18. *Evernia divaricata* (L.) Ach., tiny apical twig (Fig. 3)
19. *Hypogymnia physodes* (L.) Nyl., bark of twig
20. *Hypogymnia tubulosa* (Schaer.) Hav., bark of twig
21. *Parmelia saxatilis* (L.) Ach., rock
22. *Parmelia sulcata* Taylor, debris at the spruce base
23. *Platismatia glauca* (L.) W.L. Culb. & C.F. Culb., coniferous twig
24. *Pseudevernia furfuracea* (L.) Zopf, bark of twigs
25. *Melanohalea exasperata* (De Not.) O. Blanco et al., tree bark
26. *Melanohalea exasperatula* (Nyl.) O. Blanco et al., tree bark
27. *Usnea dasopoga* (Ach.) Nyl., tree branches and bark
28. *Usnea florida* (L.) F.H. Wigg., coniferous twig
29. *Xanthoparmelia pulla* (Ach.) O. Blanco et al. s.l., rock
30. *Xanthoparmelia conspersa* (Ehrh. ex Ach.) Hale, rock
31. *Xanthoparmelia stenophylla* (Ach.) Ahti & D. Hawksw., rock
Family *Ramalinaceae*
32. *Bacidia* sp., bark of coniferous tree
33. *Ramalina farinacea* (L.) Ach., bark of spruce, deciduous trees
Family *Stereocaulaceae*
34. *Lepraria neglecta* (Nyl.) Erichsen, s.l., bark of pine-tree
Order Lecideales
Family *Lecideaceae*
35. *Lecidea fuscoatra* (L.) Ach., rock
36. *Porpidia cinereoatra* (Ach.) Hertel & Knoph, rock
37. *Porpidia crustulata* (Ach.) Hertel & Knoph, rock
38. *Porpidia macrocarpa* (DC.) Hertel & A.J. Schwab, rock
Order Peltigerales
Family *Peltigeraceae*
39. *Peltigera canina* (L.) Willd., mossy soil
Order Rhizocarpales
Family *Rhizocarpaceae*
40. *Rhizocarpon distinctum* Th. Fr., rock

41. *Rhizocarpon geographicum* (L.) DC., siliceous rock (Fig. 5)
Order Teloschistales
Family *Teloschistaceae*
42. *Rufoplaca arenaria* (Pers.) Arup, Søchting & Frödén, rock (Fig. 9)
43. *Xanthoria parietina* (L.) Th. Fr., tree bark
Subclass Ostropomycetidae
Order Baeomycetales
Family *Baeomycetaceae*
44. *Baeomyces rufus* (Huds.) Rebent., rock
Order Ostropales
Family *Graphidaceae*
45. *Diploschistes scruposus* (Schreb.) Norman, rock (Fig. 8)
Order Pertusariales
Family *Icmadophilaceae*
46. *Icmadophila ericetotum* (L.) Zahlbr., rotten piece of wood
Family *Megasporaceae*
47. *Aspicilia cinerea* (L.) Körb., rock
48. *Circinaria caesiocinerea* (Nyl. ex Malbr.) A. Nordin, Savić & Tibell, rock
Family *Pertusariaceae*
49. *Lepra amara* (Nyl.) Hafellner, beech bark, rock
50. *Lepra albescens* (Huds.) Hafellner, bark of trees, rock
Subclass Umbilicariomycetidae
Order Umbilicariales
Family *Umbilicariaceae*
51. *Lasallia pustulata* (L.) Mérat, rock (Fig. 4)

Fifteen species of lichenized fungi (29.4%) belonging to 12 genera, collected during this work in the Dupkata Reserve, were assigned to the category *Least Concern* (LC) by Shivarov et al. (2023), i.e. *Baeomyces rufus*, *Candelariella vitellina*, *Hypogymnia physodes*, *Melanohalea exasperata*, *Parmelia sulcata*, *Protoparmeliopsis muralis*, *Pseudevernia furfuracea*, *Rhizocarpon geographicum*, *Rinodina sophodes*, *Usnea dasopoga* (=*U. filipendula*), *U. florida*, *Xanthoparmelia conspersa*, *X. pulla*, *X. stenophylla*, *Xanthoria parietina*.

Amandinea punctata was examined in water, under LM from the Dupkata Reserve on bark of twig. It showed 8-spored asci, ca. 45–60 × 14–22 µm, and brown, 1-septate, often slightly curved ascospores, 14–17 (19.5) × 5.5–7 (9) µm (Fig. 6).

Arthopyrenia analepta s.l. with hyaline, 1–3-septare, usually biguttulate spores, 23–26.5 × 5–7.5 µm, was found on beech bark from the Dupkata Reserve.

Baeomyces rufus (Fig. 2) is a montane species, inhabitant of damp, natural wet places in forest areas, in terrain depressions near dirt roads, was observed in the Reserve on siliceous rocks, N 41°46′33.6″, E 24°14′43.7″, alt. ca. 1575 m. Information about the distribution of *B. rufus* in the Rhodopi Mts can be retrieved from publications of Popnikolov, Zhelezova (1964), Mayrhofer et al. (2005), and Stoykov (2023). It was reported recently also from the Rila National Park (Stoykov, 2018b).

Hypogymnia tubulosa is well-known lichen throughout the country, growing on trees and is spread in eleven floristic regions of the country (according to Denchev et al., 2022). This less resistant species to air-pollution than *H. physodes* in Bulgaria, has been collected in June 2024 on oak twig from Eastern Forebalkan, at alt. ca. 485 m (SOMF 31583; Stoykov, unpubl.).

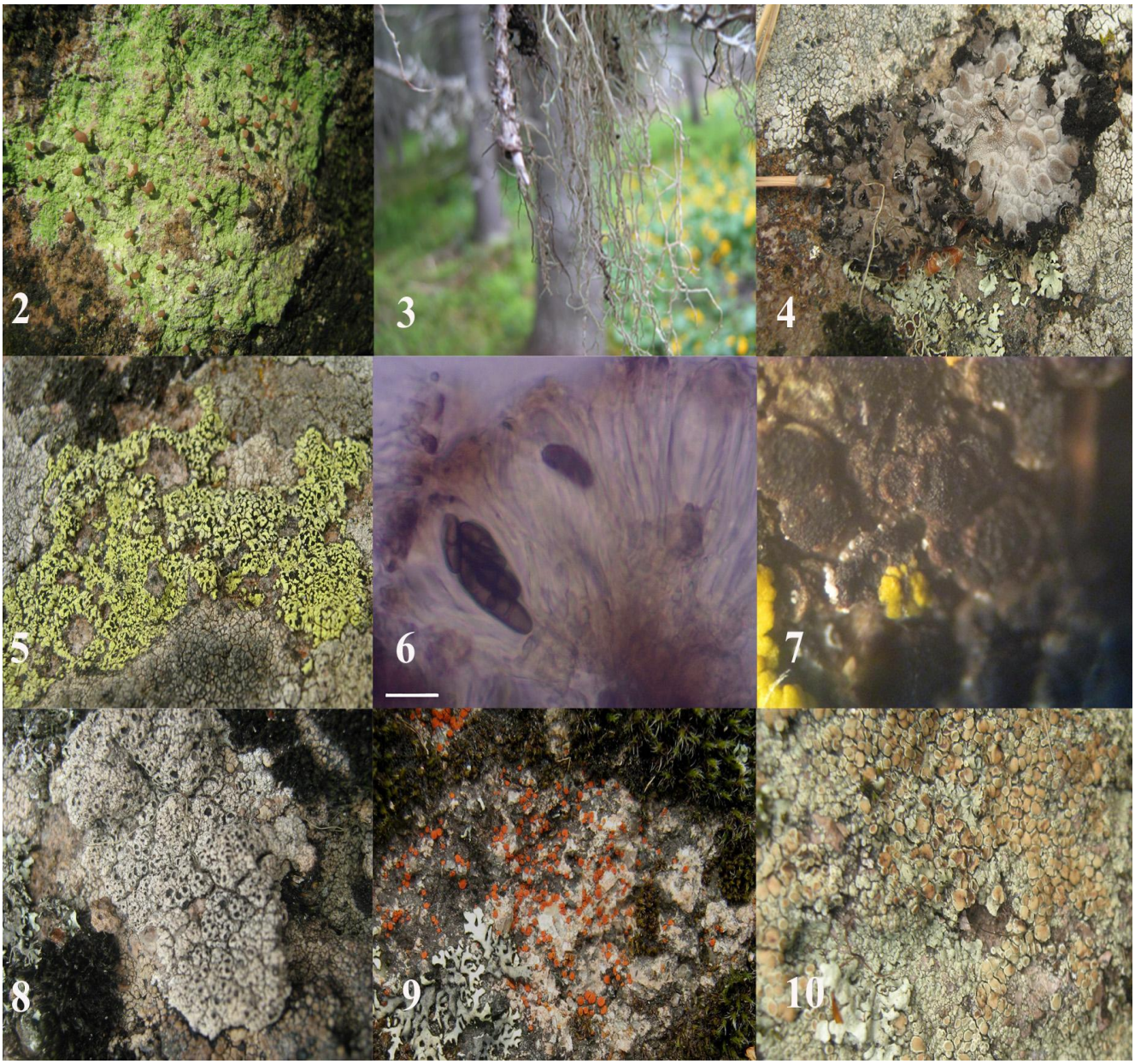
Icmadophila ericetorum has been collected in the reserve area. This species was known with specimen from Beglika Reserve, and was known in Rila and Rhodopi Mts (Stoykov, 2018b; Denchev et al., 2022).

Lepra albescens is a more common one in Bulgaria, than the similar *L. amara*, and according to Mayrhofer et al. (2005) was spread almost on all the way from Black Sea coast to West Frontier Mts. It was registered several times on bark of conifers and on pieces of rocks in Dupkata Reserve, but showed negative reactions of soralia under 5% KOH and solution of sodium hypochlorite.

Lepra amara has been found on beech bark and on rocks in the Dupkata Reserve. The species is usually remarkable with its violet reaction with KC of the soralia, after putting drops of both solutions, and with bitter taste of its soralia. It is known in Bulgaria on rocks and bark of trees from Black Sea coast, Balkan Range, Valley of Struma River, Belasitsa, Pirin, Rhodopi and Strandzha Mts (Denchev et al., 2022).

Lecanora pulicaris has been found on twigs of conifers in the Dupkata Reserve, with 1-celled spores, 10–14.5 × 6.8–9.5 µm (mean = 12.1 × 8.5), n = 11, in water. It was known from Vitosha region, Pirin, Rila and Rhodopi Mts (Denchev et al., 2022; Stoykov 2023).

Peltigera canina, a common lichen throughout the country, has been examined from the Dupkata Reserve, N 41°46′28.7″, E 24°14′56.9″, at alt. ca. 1530 m, with hemispheric dark-brown, sometimes concave, apothecia, and showed 3–5-septate, straight, hyaline ascospores with slightly pointed ends, 45–60 (65) × 3–4 (5) µm, n = 10, in water. *Rufoplaca arenaria* (Fig. 9), with minute dark red discs, was studied under LM from a single locality in the Dupkata Reserve, N 41°46′03.5″, E 24°15′55.2″, at alt. ca 1460 m, on siliceous rocks.



Figures 2-10. *Lichens from Dupkata Reserve: 2. Baeomyces rufus, thallus on siliceous rock, in situ; 3. Evernia divaricata, pendulose thallus on tree, in situ; 4. Lasallia pustulata, on rock, in situ; 5. Rhizocarpon geographicum, thallus, in situ; 6. Amandinea puctata, ascus and ascospore, in water. Scale bar = 15 µm; 7. Rinodina sophodes, dark-brown apothecia on bark, ex situ; 8. Diploschistes scruposus, thallus on rock, in situ; 9. Rufoplaca arenaria, apothecia on rock, in situ; 10. Protoparmeliopsis muralis, thalli on rock, in situ.*

So far, this species is known only from Black Sea coast, Vitosha region, and Rhodopi Mts in Bulgaria (Popnikolov, Zhelezova, 1964; Mayrhofer et al., 2005; Vondrák & Slavíková-Bayerová, 2006). Its apothecia resemble superficially one collection of *Blastenia crenularia* (With.) Arup, Søchting & Frödén near Primorsko town, with discs staining deep red in K, and broad-ellipsoid ascospores up to 15–22 × 8–11 µm in water. *Usnea florida* is a montane species, known in Bulgaria only from Balkan Range, Vitosha, Rila, Sredna Gora, and Rhodopi Mts (Denchev et al. 2022).

Conclusion

This study represents the first data about the lichen diversity in the Dupkata Reserve. According to the information obtained from the examined materials 51 species were recorded from the territory of the Reserve. They belong to 34 genera, 18 families, 13 orders, 6 subclasses, and 3 classes: *Arthoniomycetes*, *Dothideomycetes*, and *Lecanoromycetes* of the subphylum *Pezizomycotina*, phylum *Ascomycota*. The diversity of lichenized fungi from the Dupkata Reserve was presented generally by epiphytic

lichens studied from decaying wood, wooden debris, bark and branches (29 species), followed by epilitic or endolitic lichens, growing on siliceous rocks (21 species), one species was found on mossy rock, and three were epigeic species (*Cladonia furcata*, *C. fimbriata*, *Peltigera canina*), collected on soil. Future field excursions, aimed at the establishment and collecting of more species will expand the information on our knowledge about the variety of lichen mycota in this protected area

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